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THE CHANGING CONCEPT OF SUPPLY LOGISTICS SUPPORT IN THE NAVY

by

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PREFACE

In skating over thin ice our safety is in our speed.

Ralph Waldo Emerson

On October 4, 1957, the writer was in Barcelona, Spain, on board the U. S. S. THUBAN (AKA-19) serving in the capacity of Supply Officer. The ship and crew had just finished participating in the North Atlantic Treaty Organization (NATO) Operation, DEEP WATER, not too far from the borders of Russian satellite territory. We had been involved in part of the now-famous incident of the Communist plane from Bulgaria buzzing units of the massed "invasion fleet" under Vice Admiral Charles R. Brown, U. S. Navy, then Commander SIXTH Fleet.

The THUBAN was the only American ship in Barcelona harbor on the date mentioned above, and it was necessary for the writer to make certain logistics arrangements with local port authorities and banking officials for the THUBAN and other ships which were to follow.

There was, at that time, a large international scientific group meeting in Barcelona which added impetus to the world-changing event which was heralded in the local newspapers.

October 4, 1957, was the day the Russians made known to the world the advent of Sputnik.

While concluding the business arrangements with the Spanish officials the writer (only because he was an American and because to them he represented someone in official capacity) was asked for his views about the Sputnik news. The query was, of course, politely, but pleasantly, shrugged aside.

In reality, something underneath the facade of those present knew that the world would never again be the same. Time and space had been reduced to one.

This is not necessarily the beginning of a changing concept of supply logistics support, but it marks the corner around which speed has become the most important thing. It certainly marks a point at which we should take stock of just where we are in the cold war race with the Russians.

Some military authorities feel that the U. S. S. R. is ahead of us; others feel we are ahead.

It is not the thesis of this study that either is correct, but that changes are taking place and new concepts are being developed which have a definite relationship to the "race with space" and the Communists.

Space travel for military men might become a reality this year, five years from now, or perhaps never. Should this type of flight for man become commonplace, one could readily understand how the logistics support for such flights would be something unheard of today. For example, such liquid foods as milk, juice, and water might have to be packaged in plastic tubes and operated somewhat like squeezing toothpaste from a container because "outer space gravity" would not permit the pouring of the liquids. A space ship might need to stop at a fueling station on the way to the moon. Repair parts might need to be of the "do-it-yourself" variety, requiring only the bare minimum

knowledge of how to use them.

Data for such a study as that mentioned above are not available. They may be tomorrow. But, today we need to look at where we are in changing concepts of supply logistics support.

For one thing, it is the contention of this writer that today we support "systems," -- more specifically, "weapons systems," -- not just a ship or a plane or a submarine, but the deterrent weapons system of which they are a part. We think in terms of the 1,200 to 1,500 miles firing range capacity of a POLARIS missile from a nuclear-powered submarine which has been submerged for almost three months and has carried this missile half-way around the world to the enemy. One phase of logistics support for this system started with the support of the two separate crews being trained for this submarine. Certain support had to be doubled, thereafter, for many things.

We think in terms of electronic data processing as a means of keeping supply stock records with a speed and degree of accuracy equal to human capacity. A mathematical formula inserted into a computer will tell the requirements for menus, food products, storage space, length of cruise and other factors involved in determining optimum load lists, in a correlated form. This can be done in a matter of minutes at a cost of "ten cents" for electricity as compared to 30 man-days for the same calculations.

Support of research and development efforts certainly might call for items not yet conceived. Supplying these might come only as avenues of research are opened. The logistics support of research projects at the Antarctic has brought about new concepts of man's survival in places heretofore thought uninhabitable.

Support of space tests, alone, has presented challenges to logistics authorities far more complicated than endurance loading for an entire fleet.

Even surface investigation of these four subjects of changing concepts of supply logistics support -- (1) support of weapons systems, (2) the use of electronic data processing and the computer, (3) the support of research and development, and (4) the support of space projects -- might prove exhaustive. It will be possible to develop only one or two themes under each area. But, it is hoped that the reader will conclude that we are changing, that we are meeting the challenge of these changes, and that further changes, unknown to man, are yet to come.

As a U. S. Naval officer in the Supply Corps, whose parent bureau is the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., study of these changing concepts of supply logistics support generally will be confined to areas of concern to this bureau and its field activities. This procedure best lends itself to documentation and reality of application. The more etherial aspects of the changing concepts are the writer's conjectures and only history will support or deny the theory.

The writer wishes to express grateful acknowledgment to Dr. A. Rex Johnson, Director, Navy Graduate Comptrollership Program, The George Washington University, Washington, D. C., for his guidance and direction throughout the entire academic year 1960-61 and for his approval of this thesis subject.

Acknowledgment is also given to Carl W. Clewlow, Professional Lecturer in Business Administration, The George Washington University, for his review of the study and appraisal of the general concept. Professor Clewlow

generously developed the guiding definition of a "Weapons System," which definition served as a basis for a considerable part of this study.

Thomas Richard Downs

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IMTRODUCTION TO THE CHANGING CONCEPT

He that will not apply new remedies must expect new evils.

Francis Bacon

What Is Logistics?

The military expression, "An army moves on its stomach," has been attributed to Napoleon Bonaparte. Perhaps it was in 1812, after his Continental System (an economic warfare scheme against England) showed the weakness of his empire and after he had attacked Russia, his only remaining rival on the Continent. He had extended his army to Moscow, but was forced to order a retreat due to lack of supplies and winter quarters. His army was annihilated, for lack of logistics support.

Some military strategists have thought of World War II as a "war of logistics." Others feel that it was during World War I that the United States really began to feel the importance of logistics when we extended troops and supplies overseas.

At this point, it would be appropriate to determine just what the authorities say "logistics" is.

Logistics is defined as "that branch of the military art which embraces the details of the transport, quartering, and supply of troops."[1]

In its broadest interpretation it even could be thought of as embracing the mobilization of the civilian manpower and economy to provide the transport, quartering, and supply.

In his Annual Report to the President for the fiscal year 1944, Secretary of the Navy James Forrestal, later Secretary of Defense, described logistics in the following words:

> Logistics is the process of providing what is needed when it is needed where it is needed.
>
> It embraces the supply and distribution of men and materials. It involves forecasting requirements. It is the scheduling, production, assembly, storage, distribution, maintenance, repair, and replenishment of equipment. It is the procurement, training, billeting, feeding, distribution, staging, hospitalization, replenishment, and the rehabilitation of personnel.[2]

Since the above was written there has been a great deal of unification in the Armed Forces. In 1947, the U. S. Air Force became the third military service. In 1948, the Joint Chiefs of Staff issued their first Dictionary of United States Military Terms for Joint Usage. Their definition of "military logistics" has been changed several times -- sometimes only slightly -- but the April, 1953 issue is still effective, insofar as "military logistics" is concerned. It reads:

> In its most comprehensive sense those aspects of military operations which deal with:
>
> (a) Design and development, acquisition, storage, movement, distribution, maintenance, evacuation and disposition of material.
>
> (b) Movement, evacuation, and hospitalization of personnel.

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[1]Webster's New Collegiate Dictionary (Springfield, Mass.: G. & C. Merriam Co., 1953), p. 495.

[2]Navy Department, Annual Report Fiscal Year 1944, The Secretary of the Navy to the President of the United States, 10 February 1945, p. 8.

(c) Acquisition or construction, maintenance, operation, and disposition of facilities, and
(d) Acquisition or furnishing services.
It comprises both planning, including determination of requirements, and implementations.[3]

Vice Admiral George C. Dyer, U. S. Navy (Retired), former Commander of the United States Blockade and Escort Force in the Korean War, and who was, at that time, much concerned with multi-national logistical problems of supporting the naval contingents from nine different countries which made up the command of 115 ships, says that there are three fundamental elements in Naval Logistic Support. These terms are:

(a) Operational logistics
(b) Consumer logistics
(c) Producer logistics.[4]

Operational logistics is that part of the logistical effort relating to the Operating Forces of the Navy. In time of war their primary concern is obtaining success in the combat area.[5]

Consumer logistics is concerned with the determination and distribution of the requirements of the Operating Forces for material, services, and personnel.[6]

Producer logistics is concerned with the procurement of those requirements of the Operating Forces as determined by the Chief of Naval

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[3]Dictionary of United States Military Terms for Joint Usage, Departments of the Army, Navy and the Air Force (Fifth Revision) March, 1958 and JCS Pub. 1. July, 1959, p. 63.

[4]George C. Dyer, Naval Logistics (Annapolis, Maryland: United States Naval Institute, 1960), p. 11.

[5]Ibid.

[6]Ibid.

Operations.[7]

As the result of a study based on research conducted for the Logistics Research Project, The George Washington University, Washington, D. C., Rear Admiral Henry E. Eccles, U. S. Navy (Retired), has the following to say about the ever-changing concept of logistics:

> A striking example of the present different usages of the word "logistics" is found in our own Department of Defense. The Joint Chiefs of Staff definition of logistics, which has undergone several revisions in the last eight years, now includes among other matters, acquisition, storage and movement of material, and the acquisition and construction of facilities. The staff of the Joint Chiefs of Staff for years was organized to deal with three major categories of activity; strategy, logistics, and intelligence. In 1958 it was reorganized to deal with seven categories: personnel, intelligence, operations, logistics, plans and policy, communications-electronics, and joint military assistance. Thus, the Joint Chiefs of Staff recognize that supply, properties and installations all are sub-categories of the larger subject of logistics.[8]

Although this thesis is not intended to be a study of the financial management aspect of logistics support, the implications are inescapable. As Rear Admiral Eccles states, "Since our economic system is based on the use of money, financial management is a vital element in the national economy and in government."[9]

Pointing up the fact that the military strategist may find himself frustrated in national security planning because of financial considerations overriding considerations of combat effectiveness, Rear Admiral Eccles stresses:

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[7]Ibid.

[8]Henry E. Eccles, Logistics in the National Defense (Harrisburg, Pennsylvania: The Stackpole Company, 1959), p. 43.

[9]Ibid., p. 48.

> Financial considerations to a large extent govern the relation between the economic, the military, and the political factors. Financial restrictions limit the size of the forces which can be created and maintained in peace. Financial devices are used by management to restrict authority and to control operations in many diverse ways. Methods of strict financial control and accounting form a valuable tool for measuring the relative efficiency of many logistical procedures.[10]

The ever-present dollar limitation certainly will have a bearing on the direction supply logistics support takes. The weighing of cost versus application, practicality, time, and human effort, may even thwart the development of new concepts.

Vice Admiral Dyer cites a specific example of dollar-awareness:

> The cost to the Naval Establishment of the naval operations in connection with the Quemoy and Lebanon crises, over and above those of the normal cold war operations, was $83,000,000. This extra cost had to be sought from the Congress in order not to throw other features of budgeted naval programs out of kilter.[11]

A nuclear-powered submarine costs a minimum of $40,000,000, and a destroyer costs over $30,000,000.[12] Examples such as these give new meaning to the financial aspects of logistics. If the $83 million extra cost had not been appropriated by the Congress, certain research and development work on the U. S. S. GEORGE WASHINGTON (SSB(N)-598), or the reinforcing of bows and hulls of certain cargo vessels participating in Operation DEEP FREEZE, or the A4D Skyhawk and the F8U Crusader may have suffered a setback.

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[10] Ibid., p. 48.

[11] George C. Dyer, "Logistical Readiness," United States Naval Institute Proceedings (May, 1960), p. 52.

[12] Ibid., p. 53.

The opinions cited as to "What is logistics?" are not at variance with one another; rather, they reveal that logistics is capable of taking on new meaning and new breadth as circumstances demand it. And, these authoritative opinions leave little doubt as to the dictatorial power of financial considerations on all logistical concepts. Indeed, stressing the importance of sound financial management, itself, may well be one of the changing concepts of logistical support.

What Were We Doing?

The broadness of logistics support is evident when we think of the civilian economy in actual support of the military effort during World War II. The manufacture of consumer goods was neglected for the production of logistical support items -- items that had no civilian economy use.

The importance of logistical support to a Naval officer can be seen when we realize the influence this support played in former battles and campaigns.

Rear Admiral Dyer[13] points up this importance when we consider the maintenance of our fast carrier task forces during the war in the Western Pacific Ocean in 1944 and 1945, in the Sea of Japan during the Korean War, and more recently, in the crises in the Mediterranean at Suez in November, 1956, and in Lebanon in 1958. This was accomplished by on-the-spot support. This latter he calls "fluid support."

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[13]George C. Dyer, op. cit., p. 3.

During World War II, ships stayed in forward areas for many months at a time. Support ships brought logistical aid directly to the combat area. This was accomplished, in many instances, on a fairly regular schedule.

In the less forward areas, repair ships anchored and the combatant vessels came to them for tender. Otherwise, the combatant supported itself the best that it could. Many lessons were learned from "endurance loading" or from the lack of "endurance loading."

Much of this mobile support concept is in existence today -- our AKS, AF, and AO support of the SIXTH Fleet in the Mediterranean is a good example. Many of our repair ships are home-ported in foreign harbors and vessels come to them, or the repair ship supports the fleet in certain areas on a six-months' rotation basis.

The advance base concept of supply support was a gigantic undertaking of movement of men and materials during World War II. Major elements of this type of support system remain today -- NSD Guam; NSD Yokosuka, Japan; NSD Subic Bay, P. I.; and NSD Guantanamo, Cuba, are examples.

Mobile support in the form of ammunition ships, oilers, repair ships, storeships, tenders and hospital ships, which contributed so heavily to our logistic success in World War II, are very much in evidence today. The SIXTH Fleet in the Mediterranean is almost self-contained in its support. Certain routine and other emergency logistical support via Fleet Air and Military Air Transport Service originates from continental United States (or U S. bases overseas). The U. S. S. ALTAIR (AKS-32), U. S. S. RIGEL (AF-58), U. S. S. NEOSHO (AO-143), and U. S. S. PROTEUS (AS-19) are examples of mobile supply logistics support.

It is true that some of the advance bases used today were in use in World War II and that some of the "hulls" of the "floating bases" are the same, but the concept of logistical support has changed. One such example would be the electronic data processing equipment employed on board the U. S. S. ALTAIR (AKS-32), mechanizing stock reporting, record-keeping and requisitioning -- certainly a vital factor in support of our fleet in its world commitments.

Why Must We Change Our Concepts?

As the earth turns, the season change is inevitable. So it is, as the earth turns, our fleet position changes for an ocean pick-up, relative to the position of the falling capsule with a chimpanzee contained inside which has just been released from a Redstone missile.

Time, alone, demands changes! New technological advances call for changes, if for no other reason than to relieve certain drudgeries of man. The more popular phraseology for this is called, "scientific breakthrough." The Sputnik incident referred to in the Preface was one of those breakthroughs. Part of space has been conquered. Concepts must change to proceed from this point.

To some, especially those in the military, Sputnik would fall in a category of "political significance." The military exists because of political significance. Men and nations form military defenses because of world political differences.

"Economic reasons" form a major category necessitating change of concepts. Political significance and economic reasons are often so inter-

related that they may be thought of as one in certain instances.

A striking example of this is found in the following. In the November, 1959 issue of the Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, under PACIFIC BRIEFS, we find an example of one attitude taken towards foreign procurement:

RESALE NOTES

FOREIGN MERCHANDISE PROGRAMS . . . During FY 1959 Bluejackets on liberty in Hong Kong, B. C. C., spent more than two million dollars for purchases of foreign merchandise. . . . Cash sale purchase order system used in connection with the Display Room operated by the Navy Purchasing Branch guarantees good values for money spent. . . . After conversion to Navy Exchanges. . . . Display Rooms at Yokosuka and Sasebo, Japan, continue with same low mark-up previously enjoyed by forces afloat.[14]

Approximately a year later, the Bureau of Supplies and Accounts Policy Council Notes contained the following announcement:

FOREIGN PROCUREMENT

WITH APPROPRIATED FUNDS. On 16 December, DOD implemented the President's "Flow of Gold" directive with respect to the procurement of foreign purchases by overseas activities by requiring a careful review to insure that U. S. items can not fill the needs of the service. It further states that foreign items will not be purchased unless the U. S. prices (plus transportation and handling) exceed the foreign prices by 25%. Exemption from these restrictions include emergency purchases and purchases not exceeding $1,000. Two implementing directives will be promulgated in the near future -- one covering purchases for ship's store afloat and the other covering all other appropriated fund procurements.[15]

Political and economic implications are rampant under the stop the "flow of gold" directive. It could eventually lead to a diminishing advance base logistic support concept, and an increasing mobile support concept. Even

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[14]Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, "Pacific Briefs," November, 1959, p. 29.

[15]Bureau of Supplies and Accounts, Navy Department, Policy Council Notes, Report No. 474, 19 November 1960.

this latter would be affected by the "flow of gold" problem. The AF, dependent upon foreign-grown fresh produce, for more effective SIXTH Fleet replenishment, may have to dispense with those items after the initial load brought from the continental U. S. has been disbursed. Perhaps the AF will now be replenished by air lift. That element of supply logistics support may have to be changed.

Of extreme importance is what effect will the "flow of gold" problem have on overseas replenishment of our AO's. It is understood that at the present time there will be no change in our policy of procuring petroleum products overseas. Our SIXTH Fleet oilers rely on foreign petroleum products to supply them and in turn they supply the SIXTH Fleet. As of this writing, studies are being made on a case-by-case basis to ascertain if any realistic contribution can be made to the basic objectives in the President's Balance of Payments Directive.

Although it will not be too strongly emphasized in this thesis, it nevertheless must be reiterated that economic conditions, as they tie in with the Federal Budget (Department of Defense, specifically) play a tremendous role in our military concepts. In times of greater appropriations more will be spent by the Military in research and development, weapons systems change, and depth of logistical support.

During the fiscal year that Sputnik occurred (1958) our military expenditures for research, development, test and evaluation was $2,504 millions. In fiscal 1959, it was $2,866 millions; 1960, $3,732 millions; 1961, $4,148 millions (estimated), and in 1962, $4,388 millions (estimated).[16]

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[16]U. S. Government, The Budget of the United States Government for the Fiscal Year Enging June 30, 1962 (Washington: U. S. Government Printing Office, 1961), p. 1021.

Figure 1 gives a more complete breakdown of research, development, test and evaluation expenditures in relation to other categories of military defense expenditures and the total expenditure for the military function aspect of major national security.

A subject of further study might be which had the greater influence on the other -- military concepts or budgetary changes. Do we change budgets to fit military concepts, or do we change military concepts to fit budgets?

What Are the Areas of Changing Concept?

Support of Systems. -- One of the most important areas of changing concept of supply logistics support is that of the POLARIS system. A nuclear-powered submarine and this formidable weapon are a drastic change from the steaming fleet, with its following support train of ships, during World War II. Circumnavigation of the world -- submerged -- for almost three months duration, has already been proven by the U. S. S. TRITON (SSR(N)586), subsequently followed by others. Now the Navy is planning on a type of logistic support that will keep POLARIS-type submarines at sea for a year at a time. How will our support concepts change?

This study will investigate some of the changing concepts involved in the support of "systems." The specific instances will be kept small in number, and generally as they affect the Bureau of Supplies and Accounts, but the implications will be kept as broad as possible.

FIGURE 1

HISTORICAL COMPARISON OF BUDGET RECEIPTS AND EXPENDITURES BY FUNCTION, FISCAL YEARS 1958 THROUGH 1962[a]

(In Millions of Dollars)

050 Major national security:	(Actual)			(Estimated)	
	1958	1959	1960	1961	1962
061 Military defense:					
Military personnel	11,611	11,801	11,738	12,143	12,390
Operation and Maintenance	9,761	10,379	10,223	10,400	10,671
Procurement	14,083	14,409	14,312	13,753	14,372
Research, development, test and evaluation	2,504	2,866	3,732	4,148	4,388
Military construction	1,753	1,948	1,626	1,368	1,327
Revolving and management funds	651	169	416	312	238
Total, military defense (military function)	39,062	41,233	41,215	41,500	42,910

[a]U. S. Government, The Budget of the United States Government for the Fiscal Year Ending June 30, 1962 (Washington: U. S. Government Printing Office, 1961), p. 1021.

Electronic Data Processing and the Computer. -- Although the use of electronic data processing equipment and techniques is not new to the Bureau of Supplies and Accounts -- low-level clerical stock decisions have been made for several years at supply depots, supply centers and stock control points -- more recent developments have extended mobile logistic support to what could be indefinitely.

Data tape transmissions from a deployed storeship to a continental supply center (on a non-fill basis) bring supply center action in a matter of days (or hours in case of an emergency), rather than weeks or months, as in the 1950's and during World War II. Machines aboard ship read information from punched cards and convert it to electrical impulses for transmission to the supply center. The supply center knows which items the storeship filled or was unable to fill, and compiles replacements from the data. Effectiveness of support is almost 100%.

This study will also investigate, to a lesser degree, other areas of the use of electronic data processing and the computer. As they have been used for low-level stock card decisions in the past, are we now ready to make use of data processing and the computer in top-level logistical support decisions -- complete load lists for a nuclear-powered, POLARIS-firing submarine for a year's tour at sea?

Research and Development. -- The Bureau of Supplies and Accounts operates as a field activity the Navy Supply Research and Development Facility at Bayonne, New Jersey. Its title tells of some of its work. This study covers some of its more recent developments and how they tie in with our changing

concept of logistics support, particularly as the research was prompted by, or the development resulted from, the support element of a "weapons system." For example, the development of a lightweight, rapid drying uniform for wear on nuclear-powered submarines which remain submerged for long periods of time.

Certain other elements of the Antarctic DEEP FREEZE Operations as they involve supply research and development will be studied.

Support of Space Projects. -- The majority of naval officers are probably unable to realize the full implications of space development. The writer is no exception. Yet, every newspaper-reading citizen is aware that the time is approaching when man, himself, may be propelled into space -- perhaps never to return -- perhaps to open avenues of the universe presently beyond man's comprehension. The tenuous aspects of space logistical support will not be discussed in this study. But, the support of such operations as "Operation SKYHOOK," concerned with solving space communications problems in cosmic ray study, will be reported on, as well as support at missile ranges.

Space study is like space itself. Where does it lead? Whatever that answer may be, changing concepts of logistics support will accompany it.

Conclusions. -- After a more detailed discussion of the four areas chosen to illustrate our changing concept of supply logistics support in the Navy, conclusions will be drawn and the writer's conjectures will be given as to what might be areas of future change.

CHAPTER II

THE AREAS OF CHANGING CONCEPTS

> The meaning of history is never apparent to those who make it; a leader in any age or generation is no more than a man who sees somewhat beyond the end of his nose.
>
> Thomas Surge

Support of Weapons Systems

In discussing the four areas of supply logistics support to substantiate the thesis that there is a changing concept taking place, they are not presented in any order of importance. Inasmuch as they will be studied insofar as they concern the Bureau of Supplies and Accounts and its field activities, order of importance is relative. But, it will be apparent to the reader that there is a general theme running throughout this study theorizing a close correlation between the cited areas of change and the support of weapons systems. This is intentional, and for that reason, support of weapons systems is listed as the first area of discussion.

Ration-Dense Food Program. -- It is not uncommon for the daily newspaper to carry stories of survivors of automobile accidents, plane crashes, hiking trip disasters, and other such catastrophies, who have, due to some

physical incapacity, been unable to move for food or help and yet remain alive for days before aid gets to them. Some survive without food; others may live on a candy bar that may have been in their pocket, or in the glove compartment of a car at the time of the accident. It is common practice for hunters and fishermen to carry a piece of chocolate or fruit for emergency use in case they are lost, accidents happen, or motor boat failure occurs (in the case of fishermen). A man can subsist a considerable length of time on the energy value in candy -- or on nothing at all, for that matter, living on stored-up energy in the form of fat on his body.

But, the Navy provides three meals a day for a man, be he ashore, at sea, in the air, or under the sea.

Subsistence is a tremendous aspect of supply logistics support!

For years, it has been recognized, and the fact compensated for, that a Navy man's food requirements are different under various circumstances and in diverse parts of the world. The United States Navy man, being a product of the North Temperate climate zone, needs additional energy when serving in the Arctic and Antarctic zones. The Navy compensates for this by serving certain high-energy foods and what amounts to four meals a day.

For routine submarine personnel the Navy allows for the serving of high-protein foods. For example, certain leaner meats are authorized for submarine use which are not authorized for general shipboard and shore station use.

Four meals a day at sea in colder climates, or fillet mignon as a standard menu item under the sea, seems somewhat remote from the voyage of Columbus in 1492, when the crew subsisted principally on sun-dried meat "charqui" /jerkie/ and hardtack, a form of sea bread. Yet, food preservation, not entirely removed in theory from Columbus' time, remains a vital link in sustained boyages.

An examination of what is "food preservation" would seem appropriate at this point:

> Food preservation has been practiced since remotest times; early products of experiment were cheese, butter, wine, bacon, parched grain. Advances came with scientific investigation (notably by Pasteur) of causes of putrefaction. Basic preserving processes include drying, heating, (as in CANNING, and PASTEURIZATION), refrigeration (both FREEZING and CHILLING), exclusion of air, and use of such substances, as salt, sugar, vinegar, smoke, alcohol, and saltpeter. Use of certain chemicals is generally limited by legislation.[1]

For the fullest coverage of basic methods of food preservation, it should be noted that recent thought and practice have been given to "preservation" by irradiation. This treatment holds the food in sort of a state of suspension; for example, a potato does not sprout and has very little shrinkage. Also, meat is not subject to deterioration by bacteria, but when food preparation processes are applied, such as boiling, frying, roasting, or broiling, the meat turns to a state of mush. The use of the irradiation process does not have full legal sanction, as yet, and its expense is far beyond any conventional method of preservation. Yet, the implications for future logistics support may mean longer and more sustained voyages.

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[1]The Columbia-Viking Desk Encyclopedia (New York: The Viking Press, Inc., 1953), p. 432.

During World War II, great strides were made in "combat foods." Such developments as canned butter that did not melt in the tropics, processed canned meat (more commonly called "Spam," regardless of its true name), and the famous K-ration[2] which was a 32-ounce package, containing three boxes of concentrated food providing three meals (3726 calories), came into common use. Certain dehydrated processed foods developed during World War II (and later improved in use and palatability) remained in standard use aboard ship. Such examples would be dehydrated onions, green peppers, and potato granules.

The ration-dense food program was first introduced to the Navy during fiscal year 1958. It has enjoyed constant growth and expansion by the improvement of the items in the initial program and by the introduction of many new items.

Just what is "ration-dense?"

It is a concept of supply logistics support that calls for the re-examination of food processing techniques, food preservation, food packaging, food storage techniques, and menu planning to conserve space and weight, increase endurance loading, and reduce the cost of waste and spoilage.

Ration-dense has become a supply logistics concept because of our support of the POLARIS weapons system as we know it on nuclear-powered submarines. Its contribution to reduction of space requirements, yet with increased endurance loading, has helped to make a reality of the U. S. S. TRITON (SSR(N)586)'s first submerged circumnavigation of the world in 84 days.[3]

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[2]Webster's New Collegiate Dictionary (Springfield, Mass.: C. & G. Merriam Co., 1953), p. 467.

[3]Interview with Captain Strong Boozer, SC, U. S. Navy, Director, Navy Subsistence Office, Washington, D. C., February 28, 1961.

The reduction of space and weight is especially attractive to smaller ships and submarines, but it is a factor important to ships of any tonnage or design at the time of underway replenishment, that is, transferring stores from one ship, the supplier, to another, the receiver, while both are traveling side by side at sea. On most ships "striking the stores below" is still done by hand. (A noticeable exception is in the case of the larger carriers and certain storeships which make use of elevators and belt-type conveyors.) Lighter weight packages make for faster stowage and are of especial interest today when many smaller ships are operating with less-than-complement crews. Speed of handling stores in combat areas, rough seas, or inclement weather is also paramount. The less time two ships replenishing at sea have to remain on station, the less chance of collision.

Space aboard an ordinary submarine is at a premium. Aboard a POLARIS missile, nuclear-powered submarine, space is even more critical because of the increased weapons capacity.

For a comparison of the size and weight of a World War II submarine and a POLARIS-firing, nuclear-powered submarine, the following was taken from Jane's Fighting Ships 1960-61:

> U. S. S. DEVILFISH (SS-292), 1526 tons standard displacement; 311-1/2 feet in length; ten 21" firing tubes; complement of 78 to 82 men and officers.[4]
>
> U. S. S. GEORGE WASHINGTON (SSB(N)598); 5,400 tons standard displacement; 382 feet in length; four 21" firing tubes forward and 16 Polaris guided missiles (weighing 15 tons net, and measuring 28 feet in length, each); complement of 100 (10 officers and 90 men) with two complete crews that relieve each other every three months.[5]

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[4]Raymond V. B. Blackman (ed.), Jane's Fighting Ships 1960-61 (New York McGraw-Hill Book Co., 1960), p. 364.

[5]Ibid., p. 357.

One can readily see the increased displacement tonnage the nuclear-powered submarine has over the World War II type. Each added ton (provisions, other stores, repair parts, and personnel) may lessen diving or rising rapidity.

The length of the submarine has not increased in proportion to the weight, yet the nuclear-powered submarine carries many new pieces of highly technical equipment which require space. The size and weight of the weapon, itself, have increased tremendously. Space and weight must be saved elsewhere. Ration-dense has made a contribution in that direction.

Figure 2 gives an illustration of the space taken by six bulky items of regular provisioning versus the space taken by these same items under the ration-dense program.

Figure 2 shows that 20.14% space was saved on these routine necessary items. This means approximately four days' increased endurance on the space allocated to a normal 21-day load. Using the same space-saving ratio, one would achieve 50 days' endurance from space allocated to a normal 42-day load, and 72 days' endurance from space allocated to a normal 60-day load. It should again be noted that this is on only six bulky, common use items.

This space-saving by means of dehydration, condensation, repackaging, menu changing, and pre-cooking, to cover the major methods, does not apply to only six bulky items. Each year ration-dense concept has been improved and expanded until today, such dehydrated foods as applesauce, green beans, raw cabbage, fruit cocktail, cheese, fish sticks, shrimp, and vinegar, to mention only a few of the more unusual items, are in common use.

FIGURE 2

MAJOR TARGETS FOR CUBE REDUCTION[a]

Bulky Essential Foods — High Use Bulky Items

Cube Requirements with Conservative Use of "Ration-Dense" Foods.

6 Bulky Items

EGGS 5.41% (of total load)
(Eggs, shell, fresh 5.36%)
MILK 7.69%
(Milk, fluid for beverages 4.36%)
BEVERAGE 2.29%
(Coffee, roasted, ground 2.06%)
FRUIT 11.95%
VEGETABLES 28.94%
(Potatoes, white, fresh 8.75%)
(Onions, dry (fresh) 1.29%)
MEAT 13.92%
(Bacon, sliced, frozen 1.18%)
BREAD COMPONENTS 11.04%
(Includes space for initial 7-day supply commercial bread)

Representative 21-day Subsistence Load Showing
6 Items That Occupy 25.24% of Total Space

- -

"Ration-Dense" Foods That Will Increase Endurance 20%

6 Dense Items

EGGS 2.66% (of total load)
(Eggs, whole, table-grade, frozen 2.61%)
MILK 4.31%
(Milk, whole, dry for beverage .98%)
BEVERAGE 1.20%
(Coffee, instant, dry .97%
FRUIT 11.95%
VEGETABLES 21.00%
(Potatoes, whole dehydrated, diced 1.81%)
(Onions, dehydrated, sliced .27%)
MEAT 13.15%
(Bacon, pre-fried, canned .41%)
BREAD COMPONENTS 6.56%
(Galley-baked bread)

Space Savings Through Substitutions of 6 Ration-Dense
Items for 6 High-Use Bulky Items in 21-day Load

[a]Commander in Chief, Pacific Fleet Ration-Dense Food Demonstration, U.S. Naval Air Station, North Island, San Diego, California, 11 June 1958.

Ration-dense is further in evidence with such new items as dehydro-frozen pork, compressed cereal bars, compressed flour, dehydro-frozen green peas, and powdered natural grapefruit and orange juice, all designed to save space and reduce weight while increasing endurance cruising of the submarine.

As further improvements are made in the ration-dense program, the one-year cruising endurance of the nuclear-powered submarine may become commonplace. If we may assume that good food contributes favorably to the crew's morale, the Navy need not be concerned about this aspect of extended cruises as long as the ration-dense program is able to produce such a menu as that in Figure 3, composed almost entirely of standard ration-dense ingredients.

Repair Parts. -- For ships under the sea we have been concerned with keeping things as compact as possible. For those above the sea, some military authorities now are concerned that these vessels are becoming so large that their vulnerability, as a result of their increase in size, overshadows the ship's war potential. Still, other technical improvements, such as nuclear-powered carriers with their vast array of electronic equipment on board which needs supporting by repair parts, add further supply logistic support problems.

The nuclear-powered carrier, no longer dependent upon black oil from AO's for power, now has greatly extended its operational range. How can support fleets with the needed repair parts keep up with the nuclear-powered carrier? Obviously, it can't, therefore, the solution for repair parts must be that it have many more of them on board the carrier when it starts out, or have such superior electronic equipment on board that repair parts will not

FIGURE 3

MENU[a]

BEEF POT PIE WITH BISCUIT TOPPING
(canned beef with gravy*)

CORNED BEEF MULLIGAN
(canned corned beef,* dehydrated onions,* dehydrated green peppers*)

BAKED BEEF PATTIES, SPANISH STYLE
(canned hamburgers,* dehydrated onions,* dehydrated green peppers*)

HOT POTATO SALAD
(dehydrated diced potatoes,*
dehydrated onions,*
canned bacon,* dry vinegar*)

GOLDEN POTATO BALLS
(dehydrated potato granules*
dry whole milk*)

WHIPPED POTATOES
(dehydrated potato granules*
dry whole milk*)

TOSSED VEGETABLE SALAD
with
GARLIC FRENCH DRESSING
(dry vinegar,* dehydrated garlic*)

HOT ONION BUNS
(dehydrated onions*
dry whole milk*)

BUTTER

APPLE PIE A LA MODE
(dehydrated apples,* paste-type ice cream mix*)

COFFEE
(instant dry coffee*)

CREAM
(dry coffee cream*)

SUGAR

*Standard "Ration-Dense" ingredient

[a]Commander in Chief, Pacific Fleet Ration-Dense Food Demonstration, U. S. Naval Air Station, North Island, San Diego, California, 11 June 1958.

be needed. Today we must work somewhere in between the two extremes mentioned. There is a problem.

Merely for comparison emphasis, reference is again made to Jane's Fighting Ships 1960-61 for a contrast between the size of a typical World War II carrier and a nuclear-powered carrier of today:

> U. S. S. ESSEX (CVS-9), (first built in 1941), standard displacement, 27,100 tons; length, 888 feet overall; complement, 1300 peacetime and 2800 wartime.[6]
>
> U. S. S. ENTERPRISE (CVA(N)-65), standard displacement, 75,700 tons; length, 1,101 feet overall; complement, 440 officers and 4,160 men.[7]

Size (physical and complement) alone, would mean a change in concept of support for the nuclear-powered carrier. Now, we must add to size, lack of need to refuel, speed of movement, and increased mobility, to force a change in our former ways of supply logistics support.

Outside the use of nuclear energy as a source of propulsion power, probably no other technical field of advancement has had such an impact on warfare as the use of electronics. The past few decades have set a somewhat dizzying pace in the electronics field. Before World War I, a destroyer had about 60 electronic tubes in use -- generally used in radio communications. During World War II, the number expanded to 750, and by 1954, it had jumped to 4,000. Today, each destroyer has from 5,000 to 6,000 electronic tubes in use.[8]

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[6]Raymond V. B. Blackman (ed.), op. cit., p. 313.

[7]Ibid., p. 308.

[8]Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, "Experts Examine Electronic Supply," February, 1960, p. 8.

There is no available information in releasable form as to the number of electronic tubes in use in a nuclear-powered carrier, but judging from the jump in the number used in a destroyer, conjecture would be in the hundreds of thousands.

At a recent conference of electronic experts at the Bureau of Supplies and Accounts field activity, Electronics Supply Office, Great Lakes, Illinois, in discussing some of the problem areas in electronics, one of the biggest factors brought out, in addition to the increased number in use, was the increase in price. It was pointed out that a single, million dollar electronic set today is considered necessary to serve the same function as a $100,000 set of a few years ago. To illustrate this further, it was noted that just five years ago, the electronics parts bought for the Fleet and new construction cost less than a hundred million dollars. Today, that figure is three times that amount.[9]

Present at the conference was Captain J. E. Rice, U. S. Navy, Director of the Electronics Division of the Bureau of Ships, Navy Department, who had the following to say about still another problem area in electronics in addition to the increased number in use and the tremendous increase in cost:

> BuShips is trying to keep costs down and to keep equipment simple. But speeds, data rates and distances demand more complicated equipment. The problem is to try to hold complexity down to something we can afford and at least maintain in the Fleet. You can't maintain some of this equipment with a striker, and I don't think we can afford PhD's.[10]

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[9] Ibid.

[10] Ibid.

All of the problems connected with electronic spare parts have not been solved. As emphasized previously, an element of coordination must exist between the designers of the original equipment and those who supply the spares. An example of this may be found at the Bureau of Weapons, Navy Department, field activity, Naval Avionics Facility, Indianapolis, Indiana, where supply officers are working as a link between the Bureau of Weapons planner and industry, in trying to cut lead time, and meet fleet requirements ahead of original estimates. In addition, the plant conducts testing and certain pilot production runs. Some of the pilot runs have specifications so advanced in the state-of-the-art that difficulties frequently crop up in finding companies with the technical ability to produce the item. One of the largest programs to date has been the procurement of ASB-7 (the latest Navy bombing system), its components and spare parts.[11]

This furnishes some evidence of trying to get the right electronics spare with the right equipment and at the time needed.

There is further evidence (plus the improved "listings" of electronics spares originating in the Electronics Supply Office and their recommendations for new packaging designs for fast moving, inexpensive spares) of supporting this "at the place and time needed" theory.

When the U. S. S. GALVESTON (CLG-3) was in the planning stages consideration was given to the location of certain storerooms. The general

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[11]Commander D. Needham, SC, U. S. Navy, "NAFI Supplies the Timley Link with 'Little Black Boxes,'" Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, July, 1960, p. 11.

stores storeroom was located centrally to take care of popular shipboard issues. But, it was found that the number of customer issues and turnover of electronic repair parts was virtually as active as the general stores material. During fiscal year 1960, electronics stores issued on board the GALVESTON amounted to $450,000.[12]

For a guided missile ship, such as the GALVESTON, with its highly technical weapons direction systems and maze of electronics and ordnance equipment, this storeroom situation demanded change. Of course, it was changed, and normally that would be the end of it, except for the recommendation to the Bureau of Ships for future design changes. (The electronics storeroom was moved from the hold, which is normal on most ships, up next to the ordnance repair parts storeroom, to allow for "one-stop shopping.") But, while at sea it was found necessary to keep the electronics storerooms open "around-the-clock" so that parts would be available any time to technicians needing equipment for missile checkout of a "shoot."

If the reader gets the impression that all of our electronic repair parts problems are not solved, he will be in the same category as the Chiefs of several of our bureaus whose work is interrelated in the matter of repair parts applicability and availability.

The concept of electronic repair parts support is changing -- almost daily -- and mainly the change will have to take into consideration financial practicality and the technical know-how of the repairman. This latter point,

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[12]Lieutenant Commander V. P. Moore, Jr., SC, U. S. Navy, "USS GALVESTON's New Electronics Storeroom," Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, November, 1960, p. 17.

the technical ability of the repairing seaman or petty officer, may be the final dictator.

Certain of the aviation professional, technical magazines, such as Space Aeronautics, and certain members of the aircraft industry have reported making studies of the possibility of using "throw-away" spare parts versus the time and cost of repairing the old piece of equipment. This theory is not refined enough as yet for military use, but the principle behind it seems to be that there has been such a demand for miniaturization and automated testing of electronic equipment, that disposable subassemblies in practical use may be part of our answer to the lack of technical ability of the repair personnel. Microminiature components do not lend themselves to easy repair, and if a subassembly were available for certain areas where repair is likely to be needed, much time and effort could be saved. At the present time, the high cost is the reason the theory has not been put to more practical use.

Use of Electronic Data Processing and the Computer

General Application. -- Over fifty years ago, one of America's greatest educators[13] is reputed to have made a statement to the effect that electricity is a devourer of time and space. In 1961, we find this has even greater truth to it. It is felt that most scientists agree, that we have only scratched the surface in the application of electricity. We are on the threshold of new vistas as the result of the application of electricity to electronic data

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[13]Charles W. Eliot, president of Harvard University, 1869 to 1909.

processing. The tedious computation tasks formerly involved in logistics support requirements have been relegated to machine. Only the decisions need be made by man, and in certain instances (for example, a machine reads a stock card as reaching a low limit and "cuts" a requisition for replenishment), the machine makes the decision and man merely approves or disapproves of the decision.

As an example of the application to which the computer has been put in the Bureau of Supplies and Accounts, the following uses were made of a Remington Rand UNIVAC S880 which was installed in September, 1960:

> Prepare timely data for the Bureau's annual program and the budget submission, adjustment and execution.
> Process reports and data needed in managing the more than $11 billion inventory of Navy stores.
> Account for and bill other Navy bureaus for transportation, and provide timely recap information on the Navy's $180 million annual cargo transportation expenditure.
> Calculate and furnish urgently needed information on Fleet supply operations, storage space utilization and occupancy, and report on age-maintenance costs of Bureau field equipment.
> Provide complete computer services for inventory control point operations of the Fuel Supply Office, Navy Subsistence Office, and the Military Petroleum Supply Agency.
> Furnish accounting and management reports on the Navy's military assistance program.
> Consolidate plant property, reports for the entire Navy.[14]

The initial installation of such a computer was under a card-operated system. Plans were made for later adaptation to magnetic tape. More specific examples will be given later in this study.

It was estimated that by the end of 1961, field activities of the Bureau of Supplies and Accounts would have about six large computers and

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[14]Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, "BuSandA Gets A New Computer," November, 1960, p. 27.

thirteen smaller ones in use in helping to manage the $11 billion stores inventory designed to support the operating fleet.

A broader explanation[15] of two of the somewhat more imaginative immediate uses of computer application which were in indirect, and yet to some degree direct, support of the fleet, follows:

> Bid Evaluation. -- The Military Petroleum Supply Agency (jointly manned, but Navy managed) could determine the least cost of combinations of products and delivery. The peculiar bidding methods of the petroleum products industry made it quite difficult to determine which was the best bid when certain combinations were used. The computer was able to evaluate each of these combinations against the other and come up with the best solution for the Military. Other considerations besides cost could be "cranked" into the computer and statistically evaluated, faster and more accurately.
>
> Determining Optimum Load Lists. -- The use of the Ration-Dense Program in support of the Polaris system has already been discussed, but this aspect of determining optimum load lists has not. With the aid of the computer, the required food products (with all nutritional considerations taken into account), necessary storage space, length of cruise, personnel involved, menu planning, and other factors could be correlated and the optimum load list figured. Variations of the load list could be computed, changing the personnel, lessening the storage space turned over to other use (such as placement of additional electronics gear on board), or extending the cruise, until the optimum load list came out of the computer.

Replenishment Data. -- Logistics experts accept as a somewhat valid generalization that communications facilities and procedures have not kept pace with logistics requirements. The United States Navy has attempted to overcome this to some extent by the concept of mobile logistic support -- the ships supplying the replenishment food, fuel, general stores, ammunition, repair parts and facilities, and other cargo sail with the combatant fleet or rendezvous

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[15] Ibid.

with it for support of the "fighters." World-wide land supply support facilities would be too costly and politically impossible. But, even the support ship cannot possibly anticipate every need in advance and must rely, in turn, upon the United States bases for their replenishment.

All of this combatant replenishment, and auxiliary replenishment takes valuable time; thus, the generalization that communications facilities have not kept pace with the need.

To overcome this, the Commander Service Force, Atlantic Fleet, decided to experiment with electronic accounting machines afloat, with one of the objectives to improve logistics communications.[16]

When electronic accounting machines were installed aboard the U. S. S. ALTAIR (AKS-32), SIXTH Fleet stores ship, one of the machines was a transceiver. This was capable of reading information from punched cards then converting this information to electrical impulses for transmission.

Determining high and low limits from a punched card and what is needed to reach either of these two levels has been routine for this type of system for several years. The improvement in the communications aspect of supply logistic support comes into effect when the necessary replenishment impulses are put on tape and the tape transmitted via radio to the supply center -- Naval Supply Center, Norfolk, Virginia, in the case of the U. S. S. ALTAIR.

In this manner the master control supply center in the United States is constantly aware of the amount of supply support available in the mobile support fleet at anytime. The U. S. S. ALTAIR, for example, can be resupplied

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[16]Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, "Rapid 'RATT'", September, 1960, p. 15.

in less than two weeks -- limited to virtually only the speed of surface transportation. Emergencies would be handled by air.

As a result of this system the Bureau of Supplies and Accounts reports:

> SIXTHFLT has been receiving maximum supply support . . . attested to by effectiveness of ANTARES and ALTAIR . . . for items carried these two AK's have been maintaining effectiveness over 99% . . . ships have been encouraged and directed to live with items on shopping guides . . . covering 27,000 most popular items. . . . NSC Norfolk has done outstanding job in resupplying deployed AKS to insure item availability . . . tape transmission of requirements from deployed AKS to NSC NORVA has been vital factor in rapid resupply . . . as well as EAM mechanization of AKS supply department.[17]

The extent to which combat effectiveness has been increased by such a system as that discussed above is a relative subject and will not be debated in this study. It is felt, though, that there is a certain amount of logic to the thought that such limited crises and actions as Korea, Suez, and Lebanon may have been more limited in duration, and perhaps avoided, had our fleet had greater range, which might have been increased if we had had more effective support.

Program Evaluation and Review Technique. -- This sub-title has a common reference -- PERT -- and is a review technique which came as a result of the mandatory need-to-know of where we stood in our POLARIS missile program. With the aid of a digital computer, PERT consolidated all of the information (including supply logistics support) in a central place and told who was behind,

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[17]Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, "Atlantic Briefs," September, 1960, p. 36.

ahead, or on schedule with the program. This provided spots along the path for corrections so that the end result would not be an imcomplete system. Likewise,the end result is obvious, for the POLARIS-firing submarine became a reality almost two years ahead of schedule as a result of PERT. It is still in use and the technique, with modifications, could have great implications for supply logistic support.

Speaking in San Jose, California, before the Lockheed Management Association, the Honorable Cecil P. Milne, former Assistant Secretary of the Navy for Material, made a very pointed reference to a future challenge facing the field of supply logistics support involving both the PERT system of evaluation and the day-to-day computer use when he said:

> PERT was born out of the necessity to accomplish the extraordinary on a day-to-day basis. We know that we must think in the future if we are going to meet the challenge of the present.
>
> To meet this challenge, we will make increasing use of computers in our day-to-day operations when we can see a substantial pay-off. Scientifically determined decision rules help to decide what to stock and where to stock it. Instantaneous transaction recording will enable us to keep up with the movement of equipment and materials and speed up overhaul.[18]

Perhaps we have scratched only the surface in our use of electronic data processing and the computer in our replenishment techniques. Perhaps our deployment of combatant forces for maintenance of world peace could be ad infinitum.

Support of Research and Development

General. -- The Bureau of Supplies and Accounts has long recognized the value of applied research and in recent years has stressed research efforts in

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[18]Cecil P. Milne, "The World's Largest Business," Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, June, 1960, pp. 15 and 38.

advanced logistics, supply systems, and improvement and utilization of equipment and materials. One example of this has been the development of improved stores strike-down facilities in the U. S. S. SARATOGA (CVA-60). This was of extreme importance in underway replenishment from storeships and thus increased the carrier's combat readiness.

Another example has been the improved cargo-handling procedures aboard the storeships, including use of elevators, lighter weight (but stronger) cargo nets, and use of the helicopter for replenishment purposes.

The Bureau of Supplies and Accounts further engages in joint logistics replenishment studies with The George Washington University, such as the determination of the validity of usage data for aviation repair parts.

But, in what areas of research has the Bureau of Supplies and Accounts engaged that will show a changing concept of supply logistics support designed to support a "system?"

Research and Development Facility. -- At this recently established laboratory-type activity, Bureau of Supplies and Accounts' personnel have been working in many areas of general supply research, such as the one mentioned for the striking of stores procedures during underway replenishment for the U. S. S. SARATOGA. Studies were also made on the U. S. S. MISSISSINEWA (AO-144), and an improved system installed. The same type of thing is being worked on for the U. S. S. SPRINGFIELD (CLG-7), U. S. S. ZELLERS (DD-777), and the U. S. S. CHARLES S. SPERRY (DD-697).

But, specifically for the nuclear-powered, POLARIS-firing submarine, which might stay submerged for three months or more at a time, such projects as

special "wash and wear" clothing have been developed. The new outfit absorbs less water while being laundered and dries in about six minutes. It used to take an hour for drying of the same items. The advantage, of course, is that less moisture evaporates into the atmosphere. Environmental conditions aboard a submarine are of prime consideration.

A special shoe is being worked on by the Bayonne facility. This shoe would have the leather sole and sides treated in a manner that would still allow for comfort, but stand up under the wear and tear of the steel decks. Heavier shoes than the commonly-used oxford would be cumbersome and dangerous on ladders on shipboard and not allow for the flexibility necessary in going from compartment to compartment.

A few months ago the Bayonne Research and Development Facility created a new set of essentiality categories and definitions for POLARIS equipment, components and parts. This code was particularly important in learning the effect of shortages or equipment inoperability. It also told the number of redundant standby parts. This code could mean speedier action from the repair ship and the repair ship, in turn, to the supply center if the former did not have the needed part available.

(It is not known whether this code will be in common use in the other services in order that they recognize the importance of the requested assist. Certain problems of this nature are being worked on by the Armed Forces Supply Support Center.)

Operation DEEP FREEZE. -- The Department of Defense was assigned by the Congress the logistics support responsibility of the United States International Geophysical Year program in the Antarctic. The Navy assumed the greatest role among the services in the amount of support given, including locating and constructing observation stations; transporting personnel, supplies, and equipment to the Antarctic, and furnishing the housekeeping and support personnel.

One of the major obstacles to overcome, which is incumbent in most Navy support operations, was the unloading. In this case methods had to be developed for unloading onto ice platforms -- landfast, or on a sea water ice shelf. Material had to be off-loaded onto sleds. This was uaually on an ice shelf, perhaps two miles from the base, the closest point a ship such as the U. S. S. WYANDOT (AKA-92), could come. The sleds were pulled by tractors (Sno-Cats) equipped with crevasse dectors. Even though the crevasse dectors were used, a cargo sled sometimes hit soft spots and fell. It had to be unloaded and the sled righted for another start.

Support ships had to have reinforced plate on the bow and hull in order to penetrate the ice. Generally, they followed an icebreaker, but troubles still developed. The U. S. ARNEB (AKA-56) twice experienced being trapped in the ice during her first trip to the Antarctic. She suffered crushed in sides and propeller damage. Temporary repairs were effected in the Antarctic and more extensive ones were accomplished later in Australia.

Helicopter transferring of cargo became commonplace, except that aircraft had to be equipped with skis, and such things as drums of fuel were often dropped from the air to the more "inland" stations.

Much of the material and equipment for the Antarctic support is loaded at Davisville, Rhode Island. This is transported via cargo vessel direct to the Antarctic or to a staging area at Christchurch, New Zealand.[19] There certain things are stored and shipped in as needed during the "season" and as conditions permit.

Christchurch, New Zealand, is about 10,000 miles from Washington, D. C., and about 2,000 miles from McMurdo Beach in the Antarctic, site of most unloading. From Christchurch planes can take needed materials in during the off season, but even this is dangerous, and generally they do not go in until spring -- beginning in October. When summer arrives in December, ships are able to go into the ice with their cargo. The C-130 planes taking in cargo are ski-equipped, but planes with conventional landing wheels do land on the man-leveled ice runways during the warmer months.

Another problem concerning storage "under the ice" is the necessity of replacing the storage facility with a certain frequency due to being caved in from the ice. Those storage warehouses built in 1956, now have as much as 20 feet of snow and ice on top of them and the steel beams are twisted and bent, even after shoring and reinforcing. Thus, as we keep on "wintering over" in Antarctica, we will have to keep replacing warehouses and storage facilities. At the present time a new tunnel-type of storage facility is being constructed for future use, hoping it will last longer than those first constructed.

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[19]Interview with Lieutenant Commander D. F. Donahue, SC, U. S. Navy, Staff Member, Naval Support Force, Antarctica, Washington, D. C., April 5, 1961.

As long as the Navy contributes heavily to logistics support of Operation DEEP FREEZE, it will have to continue research of its own to improve that support and to meet new challenges.

Support of Space Projects. -- At this point one might ask the question, "Just why should the Navy be interested in space?"

To find an answer to this question, the Chief of Naval Operations, Admiral Arleigh A. Burke, U. S. Navy, established an ad hoc committee headed by Rear Admiral Thomas F. Connolly, U. S. Navy, to study the Navy's need in the astronautics field. As a result of their findings, the Chief of Naval Operations made an endorsement of the report to the effect that the Navy would participate fully in space technology in order to contribute the tremendous resources of the Navy to the national effort, including the logistical and operational advantages which could be gained by maritime support to space operations and development programs.[20] There are almost no elements of logistical support that will not involve some phases of supply.

The United States Navy is capable of operating on about three-fourths of the earth's surface -- all that is covered by water. Nothing but space lies above the world's oceans. It is, therefore, logical that the Navy should play a tremendous role in space development, inasmuch as most test firings of long-range missiles, flights of manned space vehicles, and space observation are most likely to be made over water areas. We have already seen how the Navy has been developing methods of continuing at sea for longer and longer periods of time, logistically supporting itself.

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[20]Charles W. Styer, Jr., and Robert F. Freitag, "The Navy in the Space Age," Naval Institute Proceedings, March, 1960, p. 92.

Spencer M. Beresford,[21] counsel for the House Committee on Science and Astronautics, says that in the future, an increasing proportion of missiles and space vehicles will be launched at sea, for reasons of safety, security, reduced costs, easier logistics, and much greater choice of launching site and direction. He also made mention of the fact that sea launches of nuclear rockets will lessen the possibility of surface contamination.

Another important fact that gives support to the thought that the Navy will play a larger role in space operations in the future is concerned with the Navy's submarine personnel having already experienced, the closest of any service personnel, simulated space environmental conditions.

"Operation SKYHOOK." -- This operation was conducted on board the U. S. S. VALLEY FORGE (CVS-45) by the National Science Foundation. It consisted of hoisting aloft two giant (411-foot tall) plastic weather balloons holding 10 million cubic feet of helium. These balloons rose to a height of 113 thousand feet, and each balloon contained 800 pounds of pure emulsion, similar to that used in photo film, which was used to trace the path of cosmic rays.[22]

Indications are that the operation was successful, but what new concept of supply logistics support was involved in the operation?

Support of additional personnel, loading and off-loading equipment, and other minor additional support requirements could hardly be considered more

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[21]Spencer M. Beresford, "Preface to Naval Strategy in Outer Space," Naval Institute Proceedings, March, 1961, p. 34.

[22]R. L. Rubel, "Solving Space Secrets," Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, April, 1960, p. 4.

than routine. Neither could maintaining 13 helium trucks be considered unusual, for the Navy is familiar with the gas and its use, but the point is that such an operation could only be conducted aboard a Navy vessel and in an isolated sea area. This certainly bears out Beresford's contention that the Navy lends itself easily to space project support.

The Pacific Missile Range. -- This range is managed by the Bureau of Weapons, Navy Department, and is the nation's largest missile firing installation. It has mainland sites, nine Pacific island installations, various instrument recovery and tracking ships, and a number of special configured aircraft. All of these have to be supported.

Some of this island support -- routine "housekeeping" -- is let out on contract. The mobile support aspect is reminiscent of theory adapted in World War II. It is still valid. But, one radical concept change in logistics for the Pacific Missile Range comes from supporting electronic, telemetry, and optical range equipment different from ordinary Navy supported equipment.[23]

In addition to supporting the Pacific Missile Range, the Navy falls heir to its share of supporting the National Aeronautics and Space Administration's project MERCURY -- putting a man into space and assuring his safe return is the ultimate objective. The main portion of this support which is unusual involves parts support to project MERCURY sites across the Pacific and into Australia. It has meant the development of a complete new requisitioning system and guide, and certain Supply Demand Control Point

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[23]Bureau of Supplies and Accounts, Navy Department, Monthly Newsletter, "Supporting the Pacific Missile Range," March, 1961, p. 20.

functions have had to be performed where considerable amounts of non-system supported equipment is in use.

Insofar as the Bureau of Supplies and Accounts is concerned, it has taken the following position:

> It is clear that the challenges provided for the Supply Corps at Pacific Missile Range are considerable. Conversely, they provide an opportunity for an individual approach to many new supply problems induced by our rapid entrance into the Space Age.[24]

It would seem that the above quotation has applicability to all phases of the Navy's changing concept of supply logistics support.

As the concluding elements of this phase of the study close with the remarks cited above, it is well to pause a moment in reflection on what the primary objective of the Navy is and the logistics support connection with it. Vice Admiral Dyer summarizes this thought by saying:

> The primary objective of the Naval Establishment is for its fighting forces to have success in combat. This calls for a high degree of readiness for combat, and for logistic support of combat.[25]

Methods of combat change. Sophistication of weapons systems alter those methods. Logistic support of the systems change. But, the primary objective must remain the same. There is no other true purpose for the Navy.

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[24] Ibid.

[25] George C. Dyer, Naval Logistics (Annapolis, Maryland: United States Naval Institute, 1960), p. 293.

CHAPTER III

SUMMARY AND CONCLUSIONS

> Opinions that are well rooted should grow and change like a healthy tree.
>
> Irving Batcheller

Summary

Since Sputnik, October 4, 1957, the Navy has seen areas of change in many concepts of warfare -- or, "peaceful co-existence." The Navy has been a party in such major crises as Leganon, Quemoy and Matsu, Cuba, and Laos. The "race with space" continues.

All action or theory references cited in this study, except the more passive ones used only for official definitions, have come into being since Sputnik. It has been the thesis of this study that there is a changing concept of supply logistics support occurring at the present. Sputnik marked the impetus point for the speed in the change. Many of the elements of the changing concept were in the making long before Sputnik, but that event of October 4, 1957, lifted the cover on many of these changes.

Only four major areas of supply logistic support -- (1) support of weapons systems, (2) the use of electronic data processing and the computer in

support functions, (3) the support of research and development, and (4) the support of space projects -- have been studied. An isolated element of any one of them would hardly justify the theory of the changing concept contended, yet there is a theme of "supporting weapons systems" that seems to be running throughout the areas discussed.

The POLARIS weapon and the nuclear-powered submarine, with its increased endurance capacity, have demanded that changes in supply logistics support take place. They have!

The increased endurance loading brought about by the Ration-Dense Program has been a major factor in the Navy's ability to operate longer periods at sea and under the sea. The goal of one year at sea for a submarine sustaining itself is only just beyond another impetus booster such as Sputnik.

It has been noted that as the sophistication of the weapons systems has come about, it has brought a tremendous increase in the use of electronic repair parts. As a general rule, our electronic gear is so complicated that our ordinary shipboard personnel cannot repair it. Electronic equipment is "delicate" and highly susceptible to breakdowns. Repairs must be made quickly and accurately. There are indications that, as the weapons systems become more complicated, we must make it possible for repairs of the system to be easier.

The use of electronic data processing and the computer for supply logistics support is not new. In more recent years they have come into more prominent use. This is a generalization that is just as applicable to the business world. The major concept change lies in the fact that the Navy has now placed electronic data processing equipment on board certain stores ships

and that this equipment not only carries on routine stock card work for the stores ship, but through a transceiver informs the parent supply center in the United States of the needs of the stores ship as the cards reveal certain stocks running low. Lead time for resupplying the stores ship has been drastically cut and two weeks' replenishment time is now normal.

There was some brief discussion about the possible application of the Program Evaluation and Review Technique (PERT) to stock coordination work. Sufficient data are not available to fully support the theory that PERT would "pay" the Navy in such areas as movement of equipment and material for speedier overhaul. There is, though, merit in the theory that PERT may be put to practical use in helping to decide what to stock and where to stock it. Most stocking is now done on a usage data basis. PERT might compensate for the fact that usage data are historic, and this historic data form the basis for projected needs. The new situation is not always like the past one and PERT may be more reliable.

The work of the Bureau of Supplies and Accounts Research and Development Facility at Bayonne, New Jersey, has already proved itself to be of value in supporting the POLARIS system. This support should increase, as well as support for the new techniques for shipboard supply concepts, such as those already put into use on the SARATOGA and the MISSISSINEWA.

The Navy began support of Operation DEEP FREEZE for the International Geophysical Year in the Antarctic, and has since progressed to almost year-round support for the needs of those "wintering over." For this purpose, we now have a staging area at Christchurch, New Zealand. Again, the versatility

of the helicopter has been proven -- this time in movement of supplies from the cargo ship which has penetrated the ice as far as it can go.

Because of the Navy's position in control of the seas, the Navy lends itself to support of space projects better than the other services. When the United States puts a man into space he will probably return by having his capsule land in the sea -- the Navy will make the rescue. But, this certainly is not to be the extent of the Navy's participation in the support of space projects.

The Navy's operation of the Pacific Missile Range is one of the largest contributions to the support of the space program. Its concept is a challenge for supply support in the Space Age.

Though our sights may be set for the conquest of outer space, the Navy must not lose view of the immediate, its primary objective -- combat success. And, the supply logistics support of combat must be flexible enough to meet the changing concepts.

Conclusions

To conclude other than that there has been a change in concept of supply logistics support in the Navy since Sputnik; that Sputnik merely marked a point of time after which speed in our "race with space" became a primary factor, and that this change in concept had been in the making before Sputnik and will continue to be in the making in the future with perhaps some other "astronomical" event forming the turning point guidepost, will have defeated the purpose of this thesis.

To conclude other than that there seems to be a general theme running through this changing concept of supply logistics support, tied in with the Navy's overall concept of support of weapons systems, will have been the result of too specific examples emphasizing only a minor aspect of the change. This was not the intent. By themselves, these specific examples of change hardly meant more than day-to-day, routine changes brought about by time or certain economic and political factors.

The reader should conclude that certain weapon systems advances are ahead of their time -- that is, technology of the systems has sometimes advanced faster than the support concepts. This has been commonplace in the aviation field for several years. Before a plane gets off the production line in mass form, "drawing board" improvements have been made to the point of making the newly produced plane obsolete. Communications is another area that has not kept pace with weapons systems advances. There is some evidence that this challenge is being met a little better than previously. The use of electronic data transmissions has helped to cut time and space considerably.

It should be recognized that some of our scientific advances have been so technical that their practicality for general Navy use by the ordinary Navy shipboard person lessons the true effectiveness of the advancement. There are cases where it has been necessary to have test equipment to "test the test equipment." There may be a remedy to this situation -- disposable subassemblies in lieu of certain complicated repair parts, the application of which would not demand great technical know-how to keep the basic systems equipment operative.

The final thought concluded should be that supply logistics support is not static. On the contrary, it is very dynamic and constantly changing. The importance of logistics support for combat success is well recognized, and this thesis has been that it has changed to assure the combat success based on changing weapons systems.

CHAPTER IV

THE FUTURE

> I hold the unconquerable belief that science and peace will triumph over ignorance and war, that nations will come together not to destroy but to construct, and that the future belongs to those who accomplish the most for humanity.
>
> Louis Pasteur

Nuclear War versus Limited War

Present day military strategists usually fall into either one of two schools of thought as to what type of war will prevail in the future -- nuclear war or limited war. Immediately, the reader will say that there are those who would follow the middle of the road between these two extremes, or that any war would have elements of either one of the two. But, by and large, both of these theories prevail in military thought in some form or other, regardless of the stand taken.

The writer will not attempt to defend either theory, though the logistics aspect of the nuclear war will be reported on first. For this, the writer again draws on Vice Admiral Dyer for a very pointed summation of the effect of a nuclear war on logistics:

> The Forces Afloat must be able to operate through the initial period of a nuclear war within their own logistic resources, carrying out the prescribed retalitory action.[1]

It would seem, then, that the Navy's best course of action under this theory is for the combatants to prepare to support themselves. To this end, Vice Admiral Dyer says:

> Logistics training to be useful must simulate wartime conditions, the same as that of the combat teams. Both nuclear war and conventional war combat conditions must be logistically trained for.
>
> A strategic concept, a campaign plan, or a battle order, which does not have a logistic implication determined before it is issued and a sound logistic feasibility assured, is like a three-legged horse in an obstacle race.
>
> If the next war is a nuclear war, logistical capabilities during the recovery period may be the factor that determines which combatant will win the final victory. If this is so, a high degree of logistical competence, as well as operational and administrative competence, will be required of major commanders, and of the staffs afloat and ashore serving these commanders.
>
> Logistics must provide the means by which the fighting gets done in the next war, as logistics have provided the means for the fighting getting done in the past wars. Except this next time, there may be no means to waste.[2]

A point or two worth emphasizing in the above quotation is that the theory is predicated on, "If the next war is a nuclear war . . .," and ". . . conventional war combat conditions must be logistically trained for." If the Navy knew the answer it could direct the bulk of its effort in one area, but the Navy does not know the correct answer, and, therefore, must continue "holding its own," while improving the old, and preparing for the new.

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[1]George C. Dyer, Naval Logistics (Annapolis, Maryland: United States Naval Institute, 1960), p. 294.

[2]Ibid.

Limited War

An earlier point in this study was that political and economic conditions demand changes in concepts of logistics. This has part of its origin, insofar as the military is concerned, in the Constitution of the United States, under the provisions whereby the civilian Chief Executive is also the Commander in Chief of the Armed Forces. His political and economic decisions have great bearing on the military.

On Monday, April 10, 1961, the following headline ran atop one of the Washington, D. C. newspapers:[3] "JFK PLEDGES TO BOOST FORCES IN EUROPE FOR 'CONVENTIONAL WAR.'"

The next day a feature story in another Washington, D. C. newspaper[4] contained, "President Kennedy pledges continued full United States military support to Europe yesterday and said this Nation will strengthen the conventional armies of its forces there."

These are statements of policy for the United States and carry commitments which will emphasize certain changes in logistical concepts.

Next year's newspaper has not been printed; it may carry implications for other changes of concept of logistics support. If it does, the Navy will change. Regardless of the assignment, the challenge will be met. It may be, for our survival, that the new challenge will have to be met.

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[3]The Washington Daily News, April 10, 1961, p. 1.

[4]The Washington Post, April 11, 1961, p. A6.

April 12, 1961

On the date cited above, the Washington Daily News ran the following headline: "REDS ORBIT THE FIRST 'COSMONAUT' AND BRING HIM BACK FEELING FINE."[5]

The following day The Washington Post headlined its paper with: "SOVIET LANDS MAN AFTER ORBIT OF WORLD; K CHALLENGES WEST TO DUPLICATE FEAT."[6]

On October 4, 1957, Sputnik provided the first real impetus for our speed-up in the "race for space," and thus brought about many changing concepts of supply logistic support. On April 12, 1961, Major Yuri Gagarin, the "Cosmonaut" referred to in the newspapers, may have become the second impetus for change. It might be said that he has helped design the key that may unlock the door of the future. It is doubted whether the world will ever again be the same. Thought will be of the universe, not just limited to earth.

It is felt certain logistics concepts will change, and change again, and again.

Tomorrow's newspaper headlines may hold the answer.

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[5] The Washington Daily News, April 12, 1961, p. 1.

[6] The Washington Post, April 13, 1961, p. 1.

APPENDIX I

LIST OF NAVAL VESSEL CLASSIFICATIONS[1]

Symbol	Classification
AF	Store Ship (refrigerated)
AKA	Attack Cargo Ship
AKS	General Stores Issue Ship
AO	Oiler
AS	Submarine Tender
CLG	Guided Missile Light Cruiser
CVA	Attack Aircraft Carrier
CVA(N)	Nuclear-Powered Attack Aircraft Carrier
CVS	Support Aircraft Carrier
DD	Destroyer
SS	Submarine
SSB(N)	Nuclear-Powered Fleet Balistic Missile Submarine
SSR(N)	Nuclear-Powered Radar Picket Submarine

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[1]Raymond V. B. Blackman (ed.), Jane's Fighting Ships 1960-61 (New York: McGraw-Hill Book Co., 1960), p. 358.

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GLOSSARY OF TERMS

Blockade. An operation employed in war by which a naval force obstructs access to the ports and shores of an enemy nation.

Complement. Numbers, ranks, and ratings of officers and men as are determined by the Chief of Naval Personnel to be necessary to fight the ship most effectively, or to perform such other duties as may be required.

Displacement. Weight of water displaced by a ship.

DOD. Department of Defense.

Endurance Loading. Loading a vessel with supplies so that it will be able to operate by itself, sustaining itself for the maximum amount of time.

Field Activity. A shore command which gets its operating funds and policy guidance from a parent bureau.

FLEET. Organization of ships and aircraft under one commander. Normally includes all types of ships and aircraft necessary for major operations.

Ladder. In a ship, corresponds to stairs in a building.

Lead Time. The time allowed or required to initiate and develop an item of military use so that it will be available and ready for use at a given time.

Lead List. A list of all of the ship's supply requirements before sailing . . . includes food, repair parts, clothing, etc.

NSC. Naval Supply Center.

NSD. Naval Supply Depot. (Smaller than a center).

Pilot Run. An initial, small quantity manufacture of an item for testing or other purposes which will later be mass-produced.

Plant Property. All of the "furniture and fixtures," "machinery and equipment," and movable property belonging to the government at an installation.

Striker. Enlisted man in training for a particular rating.

Striking Below. Storing materials below decks in storerooms.

Weapons System. The total measure of resources necessary to satisfy all functions in the research, development, procurement, distribution, maintenance, manning and use of a major item of weapons equipment. Example: The POLARIS System, including missiles, carriers (surface or sub-surface), men, and all support.[1]

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[1]Definition suggested by Carl W. Clewlow, A. M., Professional Lecturer in Business Administration, The George Washington University.